# TIGERS OF THE WORLD

The Biology, Biopolitics, Management, and Conservation of an Endangered Species

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# 1

# Bearing Witness: Observations on the Extinction of *Panthera tigris balica* and *Panthera tigris sondaica*

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## BEARING WITNESS

If you go to Bali Barat or Meru-Betiri national parks on the Indonesian islands of Bali and Java and talk with the people who live near them and who use the forest, you almost certainly will hear stories of recent encounters with tigers. When I worked there in the late 1970's, people had many stories to tell of encountering a tiger drinking near a temple, or of a tiger that regularly came and rested along a forest stream at a place called Pondok Macan (Tiger Place), and there were many other tiger stories. Animals as metaphysically important as tigers live on in our minds after they are gone. No one wants to be the bearer of the bad news; I too hoped. Why else would I travel half way around the world to be there asking these people about tigers? The lingering image of tigers and the hope they remain a part of the landscape make it difficult to date extinction events and to discover the proximal causes of the extinction.

Some of our oldest tiger fossils have been found on Java (Hemmer 1971) and tigers and man have mixed on these Sunda Shelf islands for about that long. Java is one of the most densely-populated areas on earth (Biro Pusat Statistik 1977) and yet the tiger was only recently lost and another great beast, the Javan rhino (Rhinoceros sondaicus), still lives in Ujung Kulon, a rain forest jewel. A.R. Wallace (1962) described Java in 1861 as:

> "Taking it as a whole, and surveying it from every point of view, Java is probably the very finest and most interesting tropical island in the world . . . scattered through the country, especially in the eastern part of it, are found buried in lofty forests, temples, tombs and statues of great beauty and grandeur; and the remains of extensive cities, where the tigers, the rhinoceros, and the wild bull now roam undisturbed" (pp. 75-76).

When I worked in Java in the mid-1970's, I was intrigued and impressed that tigers were still extant, a condition that seemed contrary to the dogma of extinction-prone species on which I had been weaned. A good system of nature reserves located in tiger

Fig. 1. A photograph of a Javan Tiger in the Ujung Kulon National Park taken in 1938 by A. Hoogerwerf and published as Plate 60 in Udjung Kulon, The Land of the Last Javan Rhinoceros. Reproduced with permission of E.J. Brill, Leiden.

habitat on Java (Fig. 1) and Bali was established in the mid-1930's and early 1940's (Hoogerwerf 1970), but in the end this did not suffice for the Javan tiger.

In addressing the primary task of this symposium, "A Global Tiger Survival Plan", it will be useful to keep in mind what we know about the extinction of two of the three Sunda Island tiger subspecies.

## DATING THE EXTINCTIONS

### Java

My Indonesian colleagues and I (Seidensticker and Suyono 1980) found tracks of at least three tigers living in the Meru-Betiri National Park (then reserve) in 1976. We found no evidence to suggest that "effective" reproduction was occurring. Tigers were not confining their movements to the reserve, nor where they using all the reserve area. We found no evidence that suggested any tiger had been killed recently by man, but most people living in the area were misinformed about the plight of the Javan tiger and its survival needs. A track count indicated

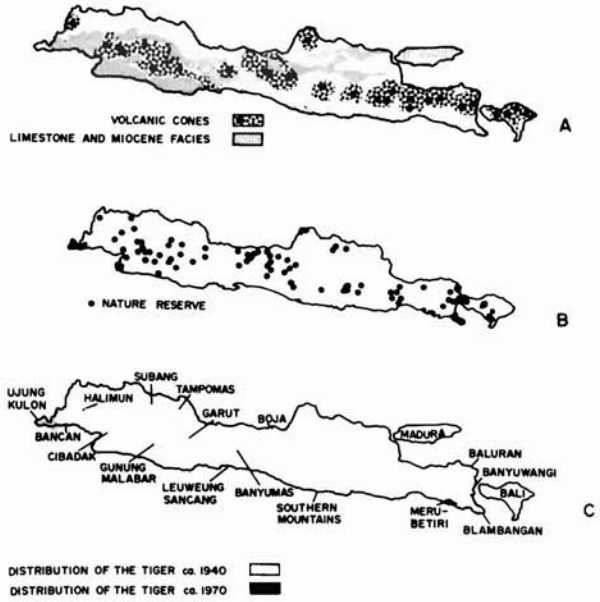


Fig. 2. Islands of Java and Bali, Indonesia: A) Landforms of Java. B) Systems of nature reserves on Java established mostly during the 1920's and 1930's. C) Decline of Panthera tigris sondaica: it was distributed over most of Java below 900 m before 1830; by 1940, it was found only is a few remote forest areas and reserves; by 1970, it lived only in the area in and around Gunung Betiri. Reproduced with the permission of the author and the National Wildlife Federation, Washington, DC.

there may have been three tigers still alive in 1979. After 1979, there has been no confirmable evidence of tigers (Blouch 1982).

I have attempted to trace the tiger's decline on Java (Fig. 2). Two hundred years ago the tiger ranged over most of the island, and as late as the 1850's,tigers were considered a nuisance in some populated areas (Harper 1945). By 1940, tigers were found only in the most remote mountain and forested areas (Treep 1973). By 1970, the only known tigers were in the Gunung Betiri complex on the eastern, south coast (Fig. 2). This is an isolated region of the Southern Mountains that has been protected in the past from extensive habitat alterations by precipitous and dissected topography. While the last tigers managed to survive there, it was not a habitat where tigers ever occurred at a very high density.

## Bali

If we use crude density estimates for tigers in good habit of

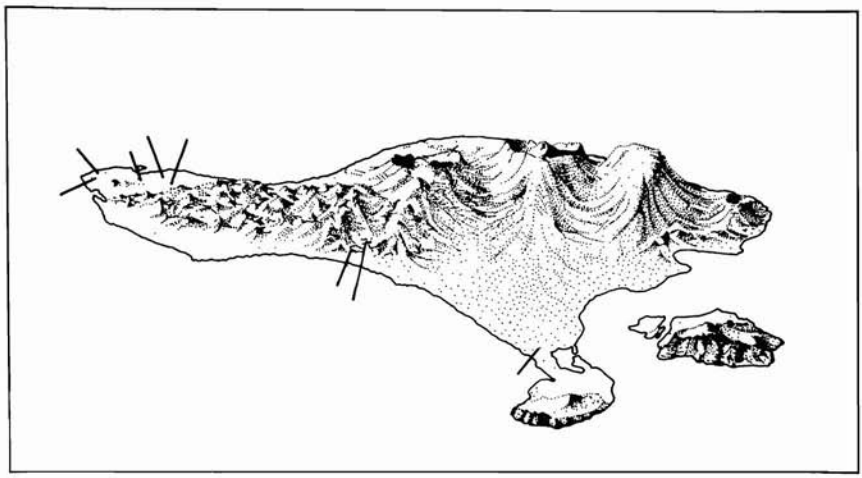

Fig. 3. Island of Bali, Indonesia, showing landforms and approximate locations of sites where museum specimens of Panthera tigris balica were collected between 1909 and 1939.

one adult/40 sq. km (Sunquist 1981) as the basis for an estimate, there were never more than about 125 adult Bali tigers at best at any one time on this 5500 sq. km island.

As I outline below, the Bali tiger population could have been regularly supplemented with tigers from Java swimming the Bali Straits (Seidensticker 1986).

We can not be as precise in reconstructing what happened on Bali as we have been on Java. Most of the known specimens of the Bali tiger (Mazak et al. 1978) entered the world's museums in the 1920's and 1930's (Fig. 3), and all but one came from western Bali. There are reports that tigers existed in Bali until the 1950's, but we have no specimens from that period. None of Clifford Geertz' (pers. comm.) informants told him about the presence of tigers when he worked in towns along the southwest coast in the late 1950's, and Lee Talbot did not find evidence of extant tigers when he surveyed Bali in 1960 (pers. comm.). The Bali Barat Game Reserve (20,000 ha) was established in 1941, and in the 1960's and 1970's, much of the adjacent forest land was planted in forest plantations (Seidensticker 1978). I suspect that most, if not all, Bali tigers were eliminated from the Island by the end of World War II. It is possible that the stragglers reported in the 1950's were immigrants swimming the 2.5 km wide Bali Straits from the Baluran Reserve on Java. Tigers in the Sundarbans swim much larger tidal rivers (Hendrichs 1975). The Bali tiger was extinct about half a century after it was first described to science by Schwarz (1912).

## ENVIRONMENTAL STRESSES AND TIGER EXTINCTION

### Java

Wet-rice or sawah agriculture is the basis of the high human populations on Java, and in some areas, Java supports 2,000 people/sq. km (Geertz 1963a). Sawah cultivation developed in Java in the rich alluvial basins surrounded by volcanoes and unirrigable limestone hills (Fig. 2). The alluvial coastal plains that comprise about half of the island were malaria-infested and posed technical irrigation problems; they were largely ignored for cultivation until the mid-1800's. From the mid-1800's through the beginning of the World War I, the Culture System efficiently and systematically brought nearly all remaining cultivatable lands in Java under production (Geertz 1963a).

The period between the Wars saw little increase in cultivatable lands. Just before World War II, it was estimated that 23% of the island remained under forest cover (Seidensticker 1986). During World War II, there was widespread deforestation without replanting (B. Galstaum pers. comm.). From 1950 through 1970, many of the remaining forest tracts were converted to plantations of teak (Tectona grandis), especially in east Java. These teak forests are generally depauperate of wildlife. By 1975, 85 million people lived in Java with less than eight percent of the land under forest cover (Seidensticker 1986).

Tigers and other wildlife declined as forested areas, alluvial plains, and river basins were converted for use in agriculture (Hoogerwerf 1970). As habitat contracted rapidly, set-guns and poison were used to remove unwanted tigers, and Hoogerwerf, (1970) also reported that ". . . many tigers fell victim to eating poisoned wild boar" (p. 244).

During the 1920's and 1930's, a system of reserves was established in Java. By the mid-1960's tigers survived only in Ujung Kulon, Leuweng Sancang, and Baluran (Fig. 2). Tigers did not survive in these reserves after mid-1960's when major civil unrest rocked the island and the reserves were sometimes used as sanctuaries by armed groups. Also during this period, disease reduced the rusa (Cervus timorensis) population in reserves and in many forest areas on Java (B. Galstaum pers. comm.).

By 1970, tigers survived only in a rugged area on the Southeast coast known as Meru-Betiri. This was established as a 50,000 ha game reserve only in 1972. Large scale plantation agriculture came to this and much of the surrounding area after World War II. Most of the areas below 1,000 m surrounding the Meru-Betiri reserve were planted in teak, coffee and rubber trees. Tiger density and home range size are strongly and positively correlated with biomass of large cervid prey (Sunquist 1981, Seidensticker 1986). Essential tiger habitat in the Meru-Betiri Reserve where we would expect good numbers of cervids, including the lower alluvial river flood plains, had been converted to plantations. By 1976, an estimated 7,000 people lived there. A few banteng (Bos javanicus) used the forest/plantation edge, but there were no rusa surviving in the reserve (Seidensticker and Suyono 1980). The tiger did not survive under these conditions.

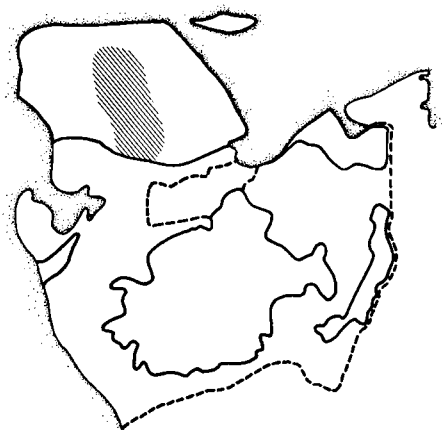

Fig. 4. Located on the western tip of Bali, the Bali Barat National Park includes the areas where the last Bali tigers were collected in the late 1930's. The 20,000 ha area of the park established as a game reserve in 1941 is shown by the dashed line; the solid lines enclose areas of the reserve not influenced by forest plantations, and the hatched areas where reasonably intact forest still remained at lower elevations in 1978. This damaged ecosystem remains an essential conservation area and is the last remaining habitat for the endemic and endangered Bali starling (Leucopasar rothschildi).

When the system of small reserves was established on Java in the 1930's, they were nestled in expanses of forest that still covered about 25% of the island. These reserves became increasingly fragmented and isolated through the next decades as forest was removed and plantations expanded. The areas where the last Javan tigers did hang on were in the largest, most diverse, and remote blocks of contiguous habitat on the island (Fig. 2): Gunung Betiri and associated river systems, Ujung Kulon-Halimun, and the Southern Mountains. With fragmentation, the largest contiguous forest blocks are 500 sq. km or less, and tigers did not survive in blocks of tropical high rain forest of this size. We would not expect these areas to support over 5-10 adult tigers, at best, at any one time (Sunquist 1981). Today there is not room on Java for tigers.

## Bali

The Balinese culture and political system developed around intensive wet-rice agriculture on palm-fringed terraces up to 700 m, especially on the southern slopes of the volcanoes (Geertz 1963b). Major land-use changes were later in coming to Bali. When plantation and small-labor agriculture for exportdid become established in the late 1880's, development focused on the northern slopes of the volcanoes and the narrow alluvial strip around the island. The relatively barren and unproductive southern peninsula and eastern end of the island were largely ignored. The Dutch did not establish colonial control until

about 1910. The major gorges and spurs and the instability wrought by frequent earthquakes made establishing a road net for the Island difficult, and it has only recently been completed. The collection sites for the last tigers were largely at the end of the road system as it existed in western Bali in the 1930's. Dutch tourist literature describes tiger hunting in western Bali in the 1930's (Dressen 1937) and apparently that is where the Dutch hunters, A. and B. Ledeboer, killed most of their tigers (Sody 1933).

The Bali Barat National Park, located on the western tip of Bali, includes the area where the last Bali tigers were collected in the late 1930's. This is an important conservation area. The area of the Park that includes the former Bali Barat Reserve has been fragmented (Fig. 4), and there is little natural forest remaining. On Bali, as in Java, there is not room today for tigers.

## COUP DE GRACE

The coup de grace to tigers in these small areas was stochastic processes or the human condition, depending on your point of view: 1) wide spread poisoning during the period while habitat was being rapidly reduced, 2) uncontrolled fragmentation of the forest during the social disruption of World War II and events following, 3) loss of critical ungulate prey populations to disease, and 4) civil unrest of the 1960`s resulting in tigers killed by armed groups seeking sanctuary in these reserves. There is not much a wildlife manager can do about this class of problem. However, we can learn the lessons from the extinction of these Sunda Island tigers: 1) it is dangerous to rely on small, isolated reserves as a means to assure the long-term survival of wild tigers; 2) large tracts of contiguous habitat are essential to assure the long-term survival of wild tigers. What will become of other wild tiger populations if these lessons do not become principles in long-term tiger conservation efforts?

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